flaming of the oil, and may at any rate lead to accident as already described, by the alarm which it occasions to nervous or ignorant persons.

(*To be continued.*)

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 18.—"On the Behaviour of the Hearts of Molluscs under the influence of Electric Currents." By Michael Foster, M.D., F.R.S., and A. G. Dew-Smith, B.A. The observations were made chiefly on the heart of the common snail.

An interrupted current, applied directly to the ventricle (or auricle), and of such a strength as not to cause tetanic contractions, produces, as has already been pointed out, distinct inhibition, altogether similar to that brought about in the vertebrate heart by stimulation of the pneumogastric nerve.

Single induction-shocks, of a strength insufficient to cause a contraction, produce no *appreciable* effect, in whatever phase of the cardiac cycle they are thrown in; but two or more such shocks, the one following the other at a sufficiently short interval, produce a slight inhibition; that is, the succeeding diastole is prolonged.

When a constant current of sufficient intensity is thrown into the ventricle at rest, a contraction or "beat" is observed at both the making and the breaking of the circuit. But the initial, making, beat starts from, and is confined to the region of, the kathode, while the final, breaking, beat starts from and is confined to the region of the anode. This is the case whatever be the position of the electrodes.

A constant current of sufficient intensity to bring about a making and a breaking beat when applied for, say five seconds, may be applied momentarily without producing any beat at all. The constant current, therefore, requires some considerable time to develop its maximum effect.

When a constant current is applied to a spontaneously beating ventricle, a polarisation of the ventricle results of such a kind that the region of the kathode is thrown into a condition which the authors would wish at present not to define more strictly than by saying that it is "favourable to the production of a rhythmic beat," while the region of the anode is thrown into an opposite condition, unfavourable to the production of a rhythmic beat.

On the withdrawal of the current a rebound takes place at either electrode, the kathode region becoming for a time unfavourable to the production of beats, the anode favourable.

Of these two conditions, the one unfavourable to the production of beats, whether it be in the anodic region during the passage of the current, or in the kathodic region during the rebound, is more easily produced by slight currents than its opposite. Hence the total effect of a slight current, the balance of the opposing agencies, is unfavourable to the production of the rhythmic beat.

Consequently, when a current, as in a single induction-shock, is applied for so short a time that its maximum effect is not reached and no direct kathodic contraction or beat is called forth, the net result is a hindrance to the rhythmic beat, or, in other words, an inhibition, which may be too slight to be recognised with a single shock, but becomes evident when the shock is repeated after a not too long interval, and is very marked when several shocks rapidly follow each other as in the ordinary interrupted current.

The main results obtained with the snail's heart were corroborated by observations on the hearts of *Sepia* and *Aplysia*.

In conclusion, the authors regarding the rhythmic beat of the snail's heart (which they believe contains no differential nervous structures) as a purely protoplasmic movement, call attention to what may be called the principle of physiological continuity, and offer suggestions towards defining the exact function of the intrinsic ganglia of the vertebrate heart, and of other spontaneously beating organs.

"On the Liquation, Fusibility, and Density of certain Alloys of Silver and Copper." By W. Chandler Roberts, Chemist of the Mint. Communicated by Dr. Percy, F.R.S.

The author states that the most remarkable physical property of silver-copper alloys is a molecular mobility, in virtue of which certain combinations of the constituents of a molten alloy become segregated from the mass, the homogeneous character of which is thereby destroyed. These irregularities of composition have long been known, and reference is made to them in the works of Lazarus Erckern (1650), and of Jars (1774). A very complete memoir was published in 1852 by Levol, who did much towards ascertaining the nature and defining the limits of this molecular mobility. He discovered the important fact that an alloy containing 71·89 per cent. of silver is uniform in composition. Its chemical formula (Ag_3Cu_2) and peculiar structure led him to conclude that all other alloys are mixtures of this, with excess of either metal.

The electric conductivity of these alloys was studied in 1860 by Matthiessen, who doubted the accuracy of Levol's theory, and viewed them as "mechanical mixtures of allotropic modifications of the two metals in each other."

The author then describes the experiments he made with a view to determine the melting points of a series of these alloys. He adopted Deville's determination of the boiling point of zinc (1040° C.) as the basis of the inquiry, and ascertained by the method of mixtures, the mean specific heat of a mass of wrought iron between 0° C. and the melting point of silver, which, as Becquerel showed, is the same as the boiling point of zinc.

The mean of three experiments, which were closely in accordance, gave 0·15693 as the specific heat of the iron; and it should be pointed out that this number includes and neutralises several errors which would affect the accuracy of the subsequent determinations.

Melting points of several alloys were then determined by plunging an iron cylinder into them and transferring the iron to a calorimeter. These melting points varied from 840° C. to 1330° C., or through a range of 490° C. The alloys which occupy the lowest portion of the curve contain from 60 to 70 per cent. of silver. The results are interesting, as they show that the curves of fusibility and electric conductivity are very similar.

Mr. Roberts then describes experiments in which alloys were cast in red-hot moulds of firebrick, the metal (about 50 oz.) being slowly and uniformly cooled. The results of these experiments on liquation are elaborate, and cannot be given in a brief abstract.

The density of pure silver and of Levol's homogeneous alloy, while in the fluid state, were then determined by the method described by Mr. Robert Mallet,* the metals being cast in conical vessels of wrought iron. The results obtained were as follows:—

	Density fluid.	Density solid.
Pure silver	9·4612	10·57
Levol's alloy	9·0554	9·9045

In the case of silver, the mean linear expansion deduced from this change of density is ·00003721 per 1° C., which is nearly double the coefficient at temperatures below 100° C.

Physical Society, March 13.—Dr. J. H. Gladstone, F.R.S., president, in the chair.—Mr. W. Chandler Roberts read a paper on the electro-deposition of iron. He referred to the beautiful specimens of electro-iron, the work of M. Eugène Klein, a distinguished Russian engineer and chemist, which were exhibited at the meeting of the British Association at Exeter. In 1870 Mr. Roberts visited St. Petersburg, and had the advantage of receiving from the late M. de Jacobi suggestions which enabled him to deposit iron with much success. He stated that a plate of electro-iron 150 mm. square by 2 mm. thick, was deposited on copper, by Herr Bockbushmann, in 1846. In 1857, M. Feuquières exhibited specimens of electro-iron at the Paris Exhibition. In 1858, M. Garnier patented in England his process, termed *aciérage*, for protecting the surfaces of engraved copper-plates; and in the same year Klein produced the admirable works above referred to. The author then exhibited specimens which he had obtained by Klein's method. The bath consists of a double sulphate of iron and magnesia, of sp. gr. 1·155; the chief conditions of success being the neutrality of the bath and the employment of a very feeble current. Iron so obtained possesses a higher conductivity than any commercial iron (Matthiessen), its sp. gr. is 8·139, and its occludes thirteen times its volume of hydrogen. A tube of the metal deposited on a rod of wax, which was vacuum-tight at the ordinary temperature, allowed hydrogen to pass freely at a dull red heat.—After a brief discussion, Prof. Guthrie described some experiments which he has recently made, with the assistance of Mr. R. Cowper, in continuation of former researches, on salt solutions and attached water. The main object of these experiments was to ascertain the manner in which mixtures of salts act as cryogens, and to study their combination

* Proc. Roy. Soc., vol. xxiii. p. 209.

with water at various temperatures and in various proportions. When two salts to which either the acid or the base is common, and which do not form a double salt, are mixed in equivalent proportion, the cryogen produced has nearly the temperature due to the salt, which alone would produce the greatest degree of cold. Solidification begins at a temperature below the melting-point of the least fusible, and continues at lower and lower temperatures until the temperature due to the other constituent salt is reached. Occasionally a cryohydrate having a constant solidifying point has been obtained by mixing in definite proportions salts which are not known to exist in the form of a double salt. In all such cases the solidifying point of the mixture is intermediate between the solidifying points of the constituents, and its temperature as a cryogen is also between the temperatures of the constituents when separately used as cryogens. When two salts composed of different acids and bases are mixed, and no precipitation occurs, it is generally considered that partial double decomposition takes place, two new salts being formed. It was found that if the salts A X and B Y be mixed in atomic proportion and dissolved in the smallest possible amount of water, a mixture identical with that produced on mixing A Y with B X is obtained. The temperature and composition of the resulting cryohydrate are the same in both cases. But the temperature never falls as low as the point which could be reached by employing whichever of the salts A X, A Y, B X, B Y, forms a cryohydrate with the lowest temperature. Thus a saturated solution of a mixture of nitrate of potassium and sulphate of sodium solidifies at $-5°$ C. A mixture of nitrate of sodium and sulphate of potassium also solidifies at this temperature. Since the solidifying point of nitrate of sodium is $-17°$, this salt cannot exist without partial decomposition taking place in either mixture; for, as has been shown above, its presence would ultimately depress the solidifying point. Dr. Rae remarked that these researches are specially interesting in connection with the salts retained by sea-ice. With a view to study this subject, he has already requested captains of whalers visiting the Arctic regions to bring home samples of ice of different age and from various localities.

PARIS

Academy of Sciences, March 15.—M. M. Frémy in the chair.—The following papers were read:—On electro-capillary action and the intensity of forces producing it, by M. Becquerel (fourth paper on the subject).—A note by H. Sainte Claire Deville, on the alloys of platinum and iron.—Researches on the fatty acids and their alkaline salts, by M. Berthelot. The subject is treated at length, and the formation of sodium, ammonium, and barium salts, both in solution and in the solid state, is considered.—On acetic anhydride, by the same; account of new experiments to determine the heat evolved during the transformation of acetic anhydride into acetic acid.—A note by M. de Lecaze-Duthiers, on the origin of the vessels in the tunica of simple Ascidia.—On the simultaneous formation of several mineral species in the thermal source of Bourbonne-les-bains (Haute-Marne), specially of galena, anglesite, pyrites, and silicates of the zeolite family (notably of chabasite), by M. Daubrée (second paper).—On a peculiar mode of excretion of gum arabic, by the *Acacia Verek* of the Senegal, by M. Ch. Martins.—Report by M. Milne-Edwards, on the measures proposed to prevent the invasion into France of the American insect Doryphora, which destroys the potatoes.—M. Mouchez, the chief of the expedition sent to St. Paul to observe the transit of Venus, was then received by the President, who welcomed him in the name of the Academy. M. Mouchez read a long paper on the subject, giving all the details of the transit. He specially described the optical phenomena observed in the vicinity of the contacts, and brings home no less than 489 photographic proofs that can all be utilised for micrometrical measurements. The two interior contacts were observed with great precision, the two outer ones having been rather spoiled by clouds. Altogether this expedition may be considered highly successful.—On the geometrical solution of some new problems relating to the theory of surfaces, and depending upon infinitesimals of the third order, by M. Mannheim (second paper).—On the simplest modes of limit equilibrium which can be present in a body without cohesion and strongly compressed; application to a mass of sand filling the angle between two solid planes and movable round their line of intersection as axis; by M. J. Boussinesq.—A memoir on the formulæ of perturbation, by M. Emile Mathieu.—Micrographic study on the manufacture of paper, by M. Aimé Girard.—On the action of sulphate of ammonia in the culture of beet-root, by M. P. Lagrange.—A note by M. F. Fouqué, on the nodules of wollastonite, fassaite pyroxene, melanite garnet of the Santorin lava.—On the immediate treatment of intestinal obstruction, by the aspiration of the gases from the intestines, by M. Demarquay.—A memoir, by M. Michal, on the determination of the results of several observations, with special reference to the precision of the result.—A note, by M. L. Berthout, on the discovery of a deposit of fossils in the plain of Ecouché, in the arrondissement of Argentan (Orne).—A number of members then made various communications on Phylloxera.—The Minister of Public Instruction addressed to the Academy a project of a medal in commemoration of the Transit of Venus.—The Minister of Public Works sent a report of the Commission charged with the proposal of measures to be adopted to prevent the infection of the River Seine in the neighbourhood of Paris.—On certain left perspectives of plane algebraic curves, by M. Halphen.—On some properties of curves traced on surfaces, by M. Ribaucour.—On diffraction and the focal properties of nets, by M. A. Cornu.—On the magnetising function of tempered steel, by M. Bouty.—On the determination of the quantity of magnetism in a magnet, by M. R. Blondlot.—On the theory of storms; a reply to M. Faye, by M. H. Peslin. M. Faye, who was present, then made some observations on the same subject.—On some double stars whose motions are rectilinear, and are due to a difference in proper motion, by M. C. Flammarion.—On the identity of the bromo-derivatives of the hydrate of tetrabromethylene with those of perbromide of acetylene, by M. E. Bourgoin.—On the quantities of heat evolved in the decomposition of the chlorides of some acids of the fatty series, by M. L. Longuinine, specially referring to butyric, isobutyric, and valeric acids.—On amylogene, or soluble starch, by M. L. Bondonneau.—On a new method of volumetric analysis of liquids, by M. F. Jean.—Chemical researches on the absorption of the ammonia of the atmosphere by the volcanic soil of the solfatara of Puzzola, by M. S. de Luca.—A reply to two recent communications of M. Béchamp, relative to spontaneous alterations of eggs, by M. U. Gayon.—Observation of the life of *Heloderma horridum*, Wiegmann, by M. Sumichrast, reported by M. Bocourt.—On the helminthological fauna of the coasts of Brittany, by M. A. Villot.—Critical observations on the classification of Palæozoic Polyps, by M. G. Dollfus.—MM. Dumay and Martin de Brettes then made some communications relating to the bolide seen on February 10 last.—A note, by M. Neyreneuf, on the combustion of explosive bodies.—A number of scientific works were presented to the Academy by several gentlemen.

BOOKS AND PAMPHLETS RECEIVED

COLONIAL.—Microscopical Notes regarding the Fungi present in Opium Blight: D. B. Cunningham, M.B., Surgeon H.M. Indian Medical Service (Calcutta).—Geological Survey of Canada; Report of Progress for 1873-74 (Dawson Brothers, Montreal).

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ERRATUM.—Vol. xi. p. 403, col. 2, lines 10 and 11 from bottom, for "work" read "rock."